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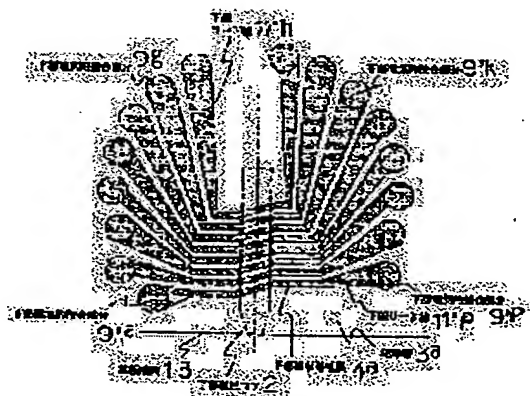
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(54) THIN-FILM MAGNETIC HEAD

(57)Abstract:

PURPOSE: To obtain a thin-film magnetic head suitable for mass production and having high reliability.

CONSTITUTION: The thin-film magnetic head is produced by the following process. A lower magnetic core 2 is formed by deposition on a substrate 1, on which an insulating layer 2a and a lower stripe conductive film 6 are formed. And an insulating layer 2a and an upper magnetic core 4, further an insulating layer 3a and an upper stripe conductive film 7 are formed thereon. The end part of the lower stripe conductive film 6 and the end of the upper stripe conductive film 7 are connected to form a helical conductive coil. The electric connecting part between the upper and lower stripe conductive films 6, 7 is made wider than the overlapping area of the upper and lower stripe conductive films on the magnetic core 4.



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CLAIMS

[Claim(s)]

[Claim 1] Carry out covering formation of the lower magnetism core on a substrate, and the lower stripes-like electric conduction film is formed through an insulating layer on said lower magnetism core. Form an up magnetism core through an insulating layer on said lower stripes-like electric conduction film, and the up stripes-like electric conduction film is formed through an insulating layer on said up magnetism core. In the thin film magnetic head in which a coil is formed the edge of said lower stripes-like electric conduction film and the up stripes-like electric conduction film is connected — having — the shape of helical one — a conductor — The thin film magnetic head characterized by the width of face for the electric joint which connects electrically said lower stripes-like electric conduction film and said up stripes-like electric conduction film being larger than the width of face of the part which laps with the magnetic core of the stripes-like electric conduction film of said upper part and the lower part.

[Claim 2] Carry out covering formation of the lower stripes-like electric conduction film on a substrate, and a lower magnetism core is formed through an insulating layer on said lower stripes-like electric conduction film. Form the up stripes-like electric conduction film through an insulating layer on said lower magnetism core, and an up magnetism core is formed through an insulating layer on said up stripes-like electric conduction film. In the thin film magnetic head in which a coil is formed the edge of said lower stripes-like electric conduction film and the up stripes-like electric conduction film is connected — having — the shape of helical one — a conductor — The thin film magnetic head characterized by the width of face for the electric joint which connects electrically said lower stripes-like electric conduction film and said up stripes-like electric conduction film being larger than the width of face of the part which laps with the magnetic core of the stripes-like electric conduction film of said upper part and the lower part.

[Claim 3] It is the thin film magnetic head characterized by connecting a part for said electric joint with the stripes-like electric conduction film of said upper part and the lower part with the lower part and up lead wire in claim 1 or claim 2.

[Claim 4] The thin film magnetic head characterized by the width of face of said lower part and up lead wire being larger than the width of face of the part which laps with the magnetic core of the stripes-like electric conduction film of said upper part and the lower part in claim 3.

[Claim 5] It is the thin film magnetic head characterized by being allotted so that said lower lead wire and up lead wire may lap through an insulating layer in claim 3 or claim 4.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the highly efficient thin film magnetic head which structure is easy and is easy to manufacture.

[0002]

[Description of the Prior Art] the former and thin film magnetic head — a substrate top — the thin film depositing method, a photolithography technique, etc. — using — a magnetic core and a conductor — a coil is formed through an insulating layer and a miniaturization and high-performance-izing are easy compared with the head of the conventional bulk mold. the conventional thin film magnetic head is shown in drawing 7 — as — a lower magnetism core (4') top — an insulating layer (3'a) — minding — the shape of a spiral — a conductor — a coil (12') carries out covering formation — having — *** — this — a conductor — covering formation of the up magnetism core (6') is carried out through the insulating layer (3'b) on the coil. the shape of an above spiral — a conductor — although the thin film magnetic head which has a coil (12') is easy to manufacture — a conductor — in case the area which a coil occupies becomes large and assembles a head, it is disadvantageous in respect of small mounting. the shape of moreover, a spiral — a conductor — by using the high permeability nature of the magnetic core (4') (6') of the lower part and the upper part, the magnetic flux generated from the current which flows in a coil (12') serves as a component of the direction of y, and is led to a head gap (5'). However, as shown in Hx of drawing 7, the fields with the coil at this time are x directions vertical to the film surface of the magnetic large core of an anti-field, and the quite big magnetomotive force to making a magnetic core reach to saturation is required for them. the shape of furthermore, a spiral — the rate of surface ratio of the part to which the magnetic core (4') (6') has lapped with the conductor (12') — very — few — a conductor — if it sees from the point of the integrated state of a coil and a magnetic core — the conventional shape of a spiral of drawing 7 — a conductor — the structure of a coil is not desirable structure. the shape of on the other hand, helical one as shown in drawing 8 — a conductor — the thin film magnetic head which has a coil (7'') — a conductor — the area which a coil occupies is small and it is suitable for small mounting. moreover, a helical conductor — the field generated from the current which flows in a coil (7'') has turned to the direction of y in the film surface of the small up magnetism core (6'') of an anti-field, and can make a head gap (5'') generate sufficient field for magnetic recording in small magnetomotive force, as shown in Hy of drawing 8 the shape of furthermore, helical one — a conductor — with the coil, the rate of surface ratio of the part to which a magnetic core laps with a coil is very large, and has the big advantage that both joint effectiveness is very high. however, the conductor of 1 turn — the conductor of that the complicated process of formation of a conductor layer, configuration processing by etching, formation of an insulating layer, and through hole processing is required although a coil is formed, and an a large number volume — when producing a coil, as shown in a part for the electric joint of drawing 8 (9''), the small connection place of area increased, and it has been made into a fault for there to be a problem also in respect of dependability.

[0003]

[Problem(s) to be Solved by the Invention] This invention is made in view of the fault of the above-mentioned conventional example, and it is suitable for mass production nature, and aims at moreover offering the reliable thin film magnetic head.

[0004]

[Means for Solving the Problem] This invention carries out covering formation of the lower magnetism core on a substrate, and forms the lower stripes-like electric conduction film through an insulating layer on said lower magnetism core. Form an up magnetism core through an insulating layer on said lower stripes-like electric conduction film, and the up stripes-like electric conduction film is formed through an insulating layer on said up magnetism core. In the thin film magnetic head in which a coil is formed the edge of said lower stripes-like electric conduction film and the up stripes-like electric conduction film is connected — having — the shape of helical one — a conductor — the width of face for the electric joint which connects electrically said lower stripes-like electric conduction film and said up stripes-like electric conduction film — the shape of stripes of said upper part and the lower part — a conductor — it is characterized by being larger than the width of face of the part which laps with a membranous magnetic core.

[0005]

[Function] According to the above-mentioned configuration, since the lower part and the up stripes-like electric conduction film are electrically joinable in a big area as compared with a part for the electric joint of the

conventional structure of drawing 8 (9'), the thin film magnetic head with the high dependability suitable for mass production nature is realizable.

[0006]

[Example] Hereafter, the example of this invention is explained to a detail, referring to a drawing. The top view of the thin film magnetic head in which drawing 1 (a) shows one example of this invention, and drawing 1 (b) are the A-A'-B-B' [in / in the sectional view which met the line, and drawing 1 (c) / a top view (a)] sectional views in a top view (a). Among drawing, (1) is a substrate which consists of nonmagnetic ceramics, such as ferromagnetic oxide ingredients, such as a Mn-Zn ferrite and a nickel-Zn ferrite, or glass ceramics, and covering formation of the lower magnetism core (2) which consists of high permeability magnetic thin films, such as a permalloy, Sendust, and Co system amorphous magnetism alloy, is carried out on the top face of this substrate (1). On said lower magnetism core, the lower stripes-like electric conduction film (4) of about 2-micrometer thickness which consists of electrical conducting materials, such as Cu and aluminum, through the insulating layer (3a) which consists of an insulating material of SiO₂ grade is formed. On this lower stripes-like electric conduction film (4), the insulating layer (3b) of about 1-micrometer thickness is formed. On the aforementioned insulator layer (3b), covering formation of the up magnetism core (5) which consists of a high permeability magnetic thin film is carried out. As shown in drawing, in order to form an efficient head gap (10), said up magnetism core (5) is produced so that the head of a magnetic pole and spacing of a magnetic substrate may become narrow. It exposes to the same field as the end face of a substrate (1), and the end face of a lower magnetism core (2) and an up magnetism core (5) serves as a magnetic pole of a head gap (5). The other end of said lower magnetism core (2) and an up magnetism core (5) is magnetically joined by the amount of [by which an insulating layer (3) and (6) were removed] (12) magnetic joint. On said up magnetism core (5), the up stripes-like electric conduction film (7) is formed through about 1-micrometer insulating layer (6a). although said lower part and the up stripes-like electric conduction film (4), and (7) **** an up magnetism core (5), an edge is not connected with each other near the up magnetism core, but they are connected by part for the electric joint separated from the upper part and a lower magnetism core with the lower part and up lead wire (11') (11) (9) — having — the shape of helical one — a conductor — it becomes a coil. By adopting such structure, a part for an electric joint (9) was able to be made into width of face as compared with the conventional structure of drawing 8, and was able to be taken to 16 or more times in 4 or more times and area. thereby — the shape of helical one — a conductor — the yield of a coil and the dependability of the thin film magnetic head improved by leaps and bounds. Moreover, lower lead wire (11') and up lead wire (11) were carrying out the completely same configuration, and since the field generated with these two conductors was negated to each other and suited him, the increment in the inductance by having lengthened lead wire far away was able to be suppressed to minimum. Next, the manufacture approach of the thin film magnetic head of the above-mentioned example is explained. First, covering formation of the lower magnetism core (2) is carried out by techniques, such as vacuum evaporation, sputtering, and a photolithography, on the top face of a substrate (1). Next, an insulating layer (3a) is evenly formed in the top face of the substrate (1) equipped with said lower magnetism core (2). Next, as shown in drawing 2, covering formation is carried out by techniques, such as a part for a lower stripes-like electric conduction film (4a) — (4h) lower lead-wire (11'a) — (11'p) lower joint — (9'p) (9'a), vacuum evaporation, sputtering, and a photolithography. under the present circumstances, the up stripes-like electric conduction film (7) with which said lower stripes-like electric conduction film (4) is produced at an after process — lapping — the shape of helical one — a conductor — it is allotted so that it may become a coil. Next, an insulating layer (3b) is evenly formed throughout the top for said lower stripes-like electric conduction film (4), lower lead wire (11'), and a lower joint (9'). Next, as shown in drawing 3, a through hole (14a) is produced by etching processing, and the front face of the lower magnetism core (2) used as a part for said lower magnetic joint (12) is exposed. Moreover, processing for producing an efficient head gap is also performed. Next, covering formation of the up magnetism core (5) which carried out the almost same configuration as said lower magnetism core (2) is carried out by techniques, such as vacuum evaporation, sputtering, and a photolithography. The lower part and an up magnetism core are joined by part for this process and a magnetic joint (12). Next, an insulating layer (3a) is evenly formed throughout the top face containing said up magnetism core (5). Next, as shown in drawing 4, a through hole (14b) is produced by etching processing, and a part for said lower electric joint (9') is exposed. Next, as shown in drawing 5, covering formation of a part for an up stripes-like electric conduction film (7a) — (7h) up lead-wire (11a) — (11p) up electric joint — (9p) (9a) and the terminal (8a) (8b) is carried out by techniques, such as vacuum evaporation, sputtering, and a photolithography. this joins electrically a part for a part for said lower electric joint (9'), and said up electric joint (9) — having — said lower stripes-like electric conduction film (4) and said electric conduction-on up stripes film (7) — electric — being connected — the shape of helical one — a conductor — it becomes a coil. Next, as shown in drawing 1 (b) and (c), an insulating layer (6b) is formed in a front face all over the districts for protection. One example of this invention is completed according to the above process. The top view of the thin film magnetic head in which drawing 6 (a) shows another example of this invention, and drawing 6 (b) are the A-A'-B-B' [in / in the sectional view which met the line, and drawing 6 (c) / a top view (a)] sectional views in a top view (a). It is the substrate which consists of nonmagnetic ceramics, such as (1) glass ceramics, among drawing, and the lower stripes-like electric conduction film (4) of about 2-micrometer thickness which consists of electrical conducting materials, such as Cu and aluminum, is formed in the top face of this substrate (1). It is ** about the insulating layer (3a) which consists of an insulating material of SiO₂ grade on said lower stripes-like electric conduction film (4). It carries out and covering formation of the lower magnetism core (2) which consists of high permeability magnetic thin films, such as a permalloy, Sendust, and Co system amorphous magnetism alloy, is carried out. On said lower

magnetism core, the insulating layer (3b) of about 1-micrometer thickness is formed. On said insulating layer (3b), the up stripes-like electric conduction film (7) is formed. On this up stripes-like electric conduction film (7), covering formation of the up magnetism core (5) which consists of a high permeability magnetic thin film through the aforementioned insulating layer (6a) is carried out. As shown in drawing, in order to form an efficient head gap (10), said up magnetism core (5) is produced so that the head of a magnetic pole and spacing of a magnetic substrate may become narrow. It exposes to the same field as the end face of a substrate (1), and the end face of a lower magnetism core (2) and an up magnetism core (5) serves as a magnetic pole of a head gap (10). The other end of said lower magnetism core (2) and an up magnetism core (5) is magnetically joined by the amount of [by which an insulating layer (3) and (6) were removed] (12) magnetic joint, the point that this example of drawing 6 differs from the example before drawing 1 **** a lower magnetism core (5), and an edge is not connected with each other near the lower magnetism core, but said lower part and the up stripes-like electric conduction film (4), and (7) connect by part for the electric joint separated from the upper part and a lower magnetism core with the lower part and up lead wire (11') (11) (9) — having — the shape of helical one — a conductor — it is becoming a coil, adopting such structure — a front example — the same — the shape of helical one — a conductor — the yield of a coil and the dependability of the thin film magnetic head improved by leaps and bounds. Since the width of face of the part for an electric joint and lead wire which are the basic matters of the claim of this invention includes the matter of being larger than the width of face of the part which laps with the magnetic core of the electric conduction-on stripes film, if this example is the expert of this field, it will be able to understand it easily that the above-mentioned example is included in the range of this invention.

[0007]

[Effect of the Invention] According to this invention, as compared with structure, manufacture is conventionally easy, and the thin film magnetic head of the high-reliability suitable for mass production nature can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

- [Drawing 1] The top view and sectional view of the thin film magnetic head
[Drawing 2] The top view showing the manufacture approach of the thin film magnetic head
[Drawing 3] The top view showing the manufacture approach of the thin film magnetic head
[Drawing 4] The top view showing the manufacture approach of the thin film magnetic head
[Drawing 5] The top view showing the manufacture approach of the thin film magnetic head
[Drawing 6] The important section top view showing other examples of the thin film magnetic head
[Drawing 7] The conventional top view and conventional sectional view of a thin film head.
[Drawing 8] The conventional top view and conventional sectional view of a thin film head.

[Description of Notations]

- 1 Substrate
- 2 Lower Magnetism Core
- 3 Insulating Layer
- 4 Lower Stripes-like Electric Conduction Film
- 5 Up Magnetism Core
- 6 Insulating Layer
- 7 Up Stripes-like Electric Conduction Film
- 7" the shape of helical one — a conductor — coil
- 8 Terminal
- 9 A Part for Electric Joint
- 10 Head Gap
- 11 Lead Wire
- 12 A Part for Magnetic Joint
- 12' the shape of a spiral — a conductor — coil
- 13 Substrate End Face
- 14 Through Hole

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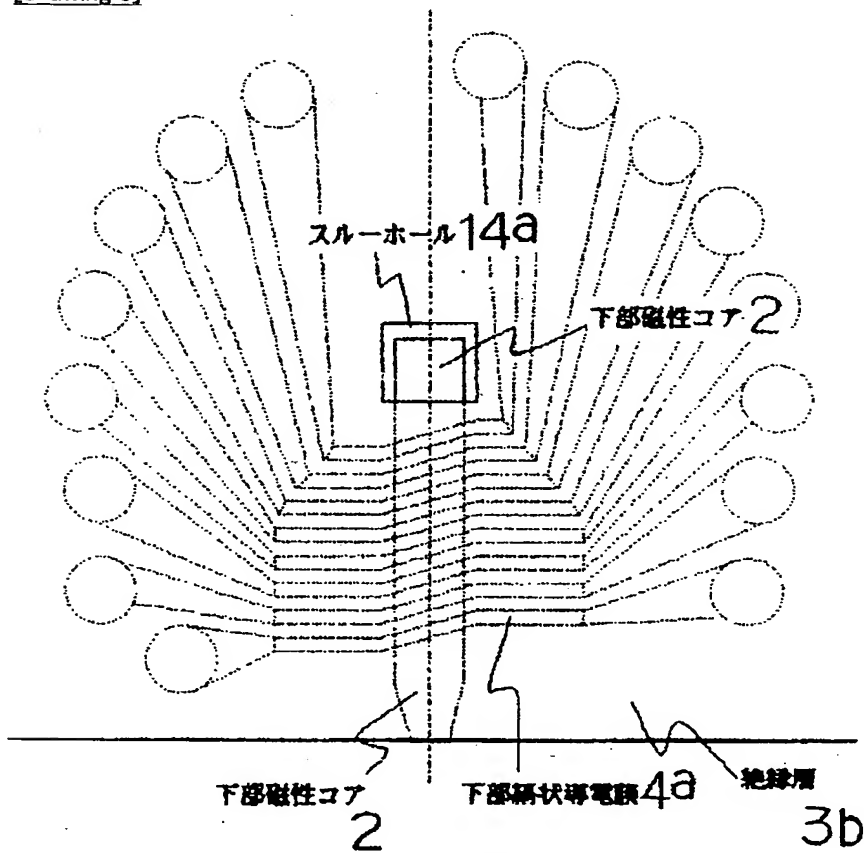
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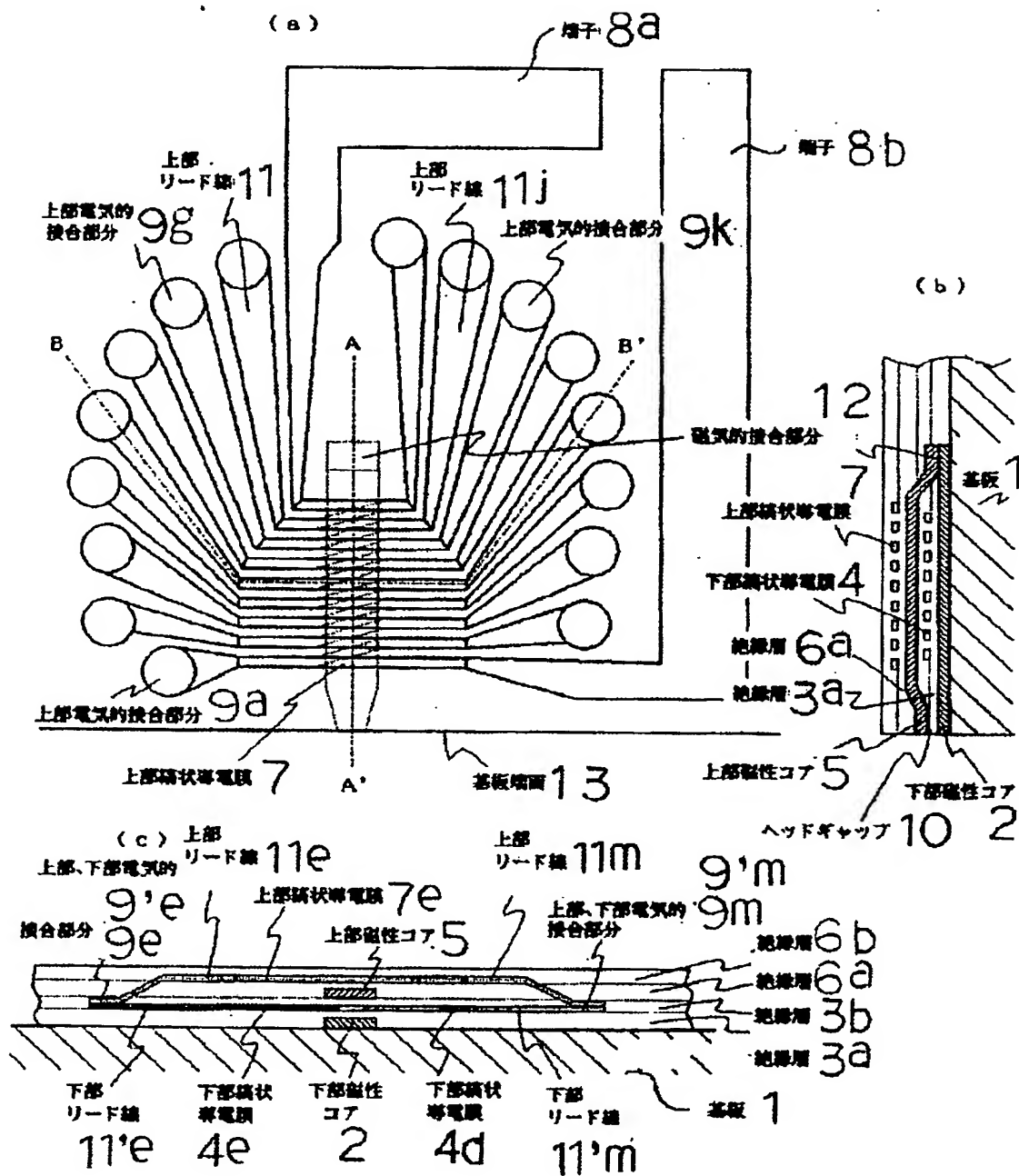
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DRAWINGS

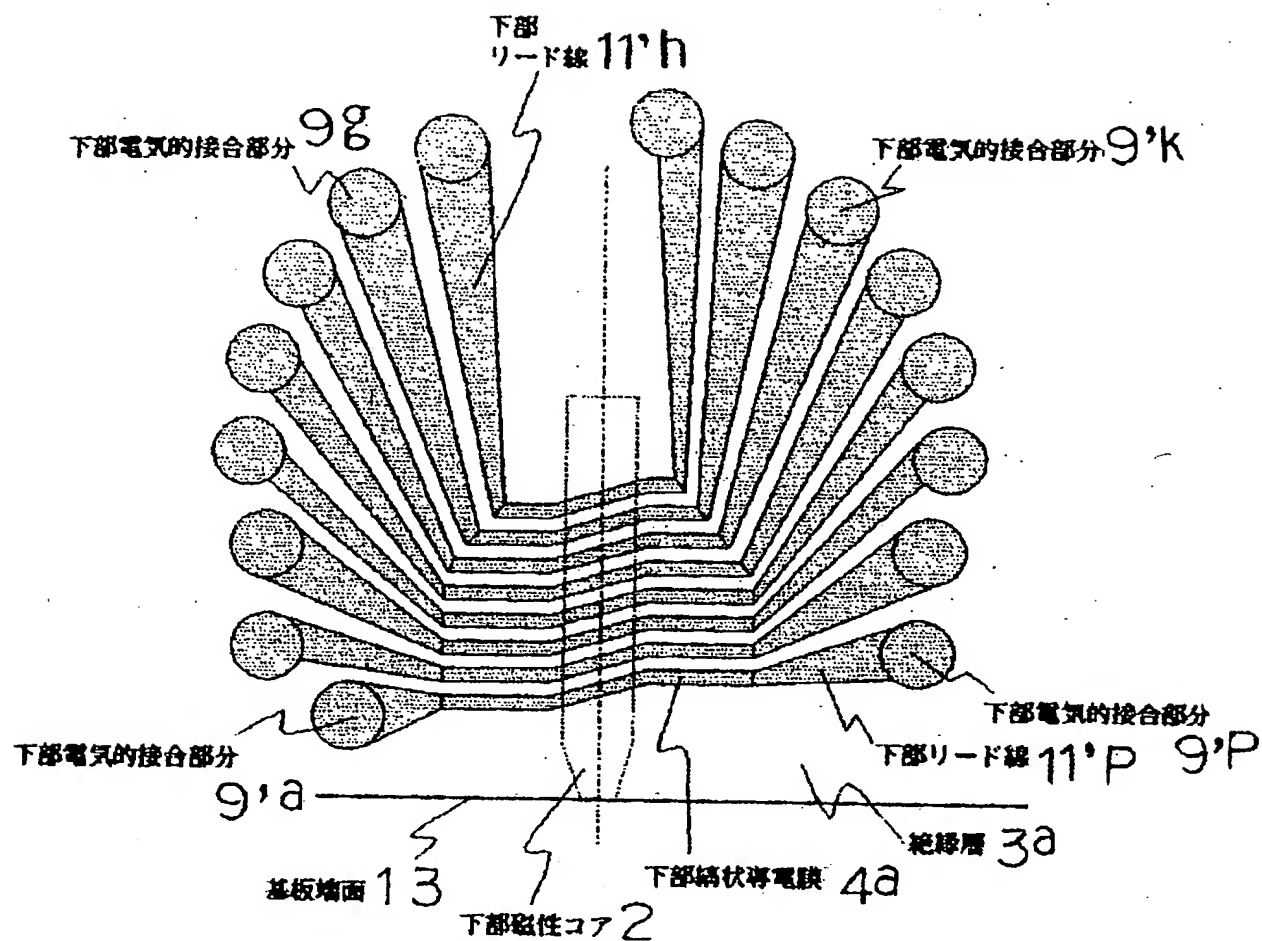
[Drawing 3]



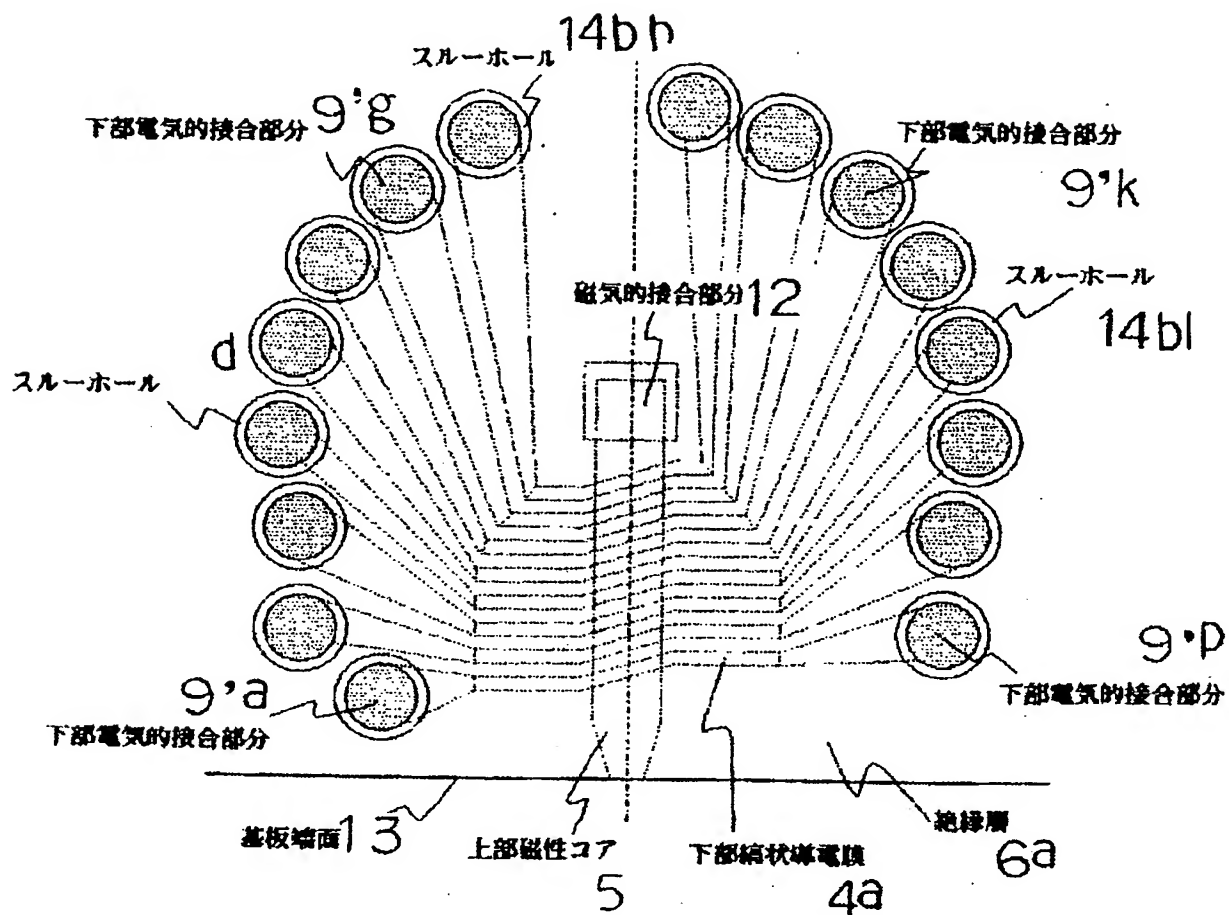
[Drawing 1]



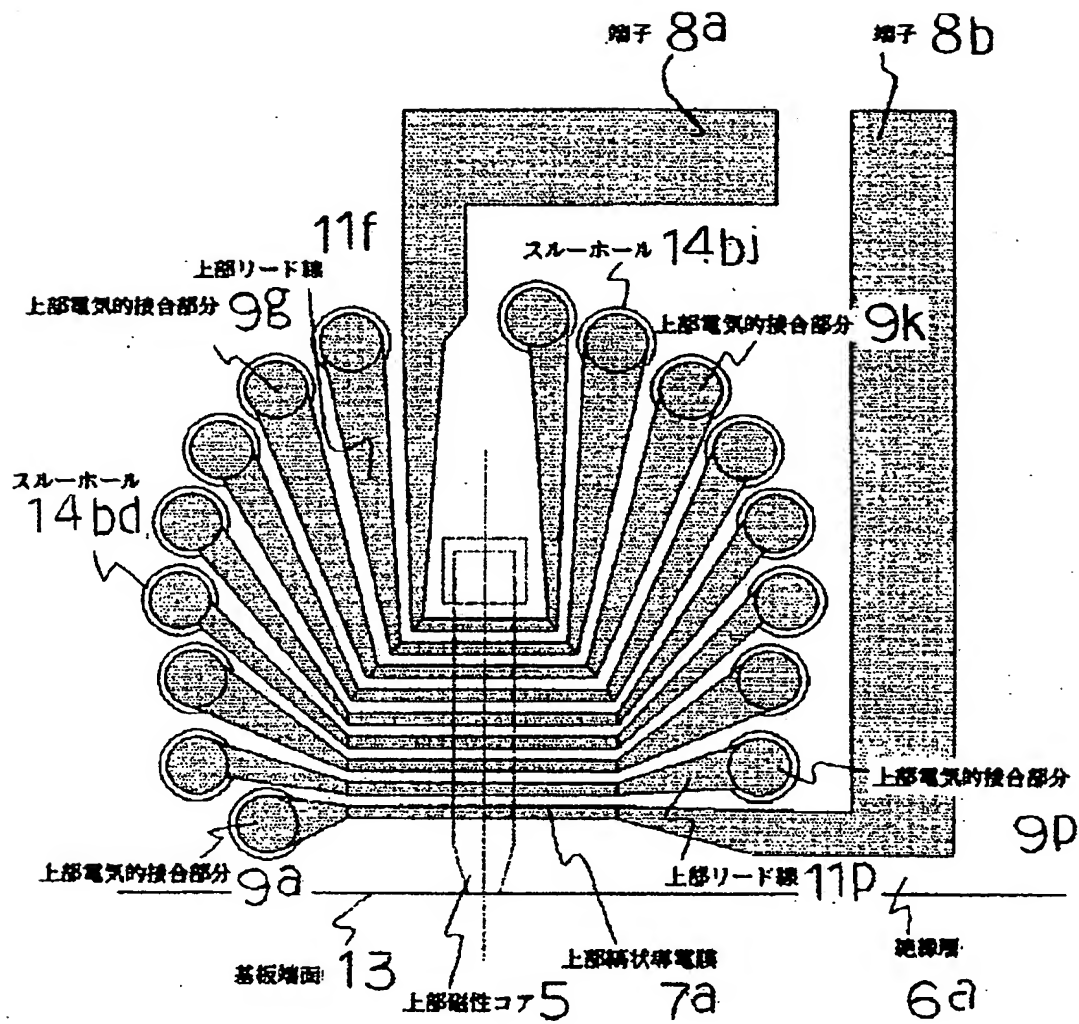
[Drawing 2]



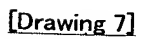
[Drawing 4]

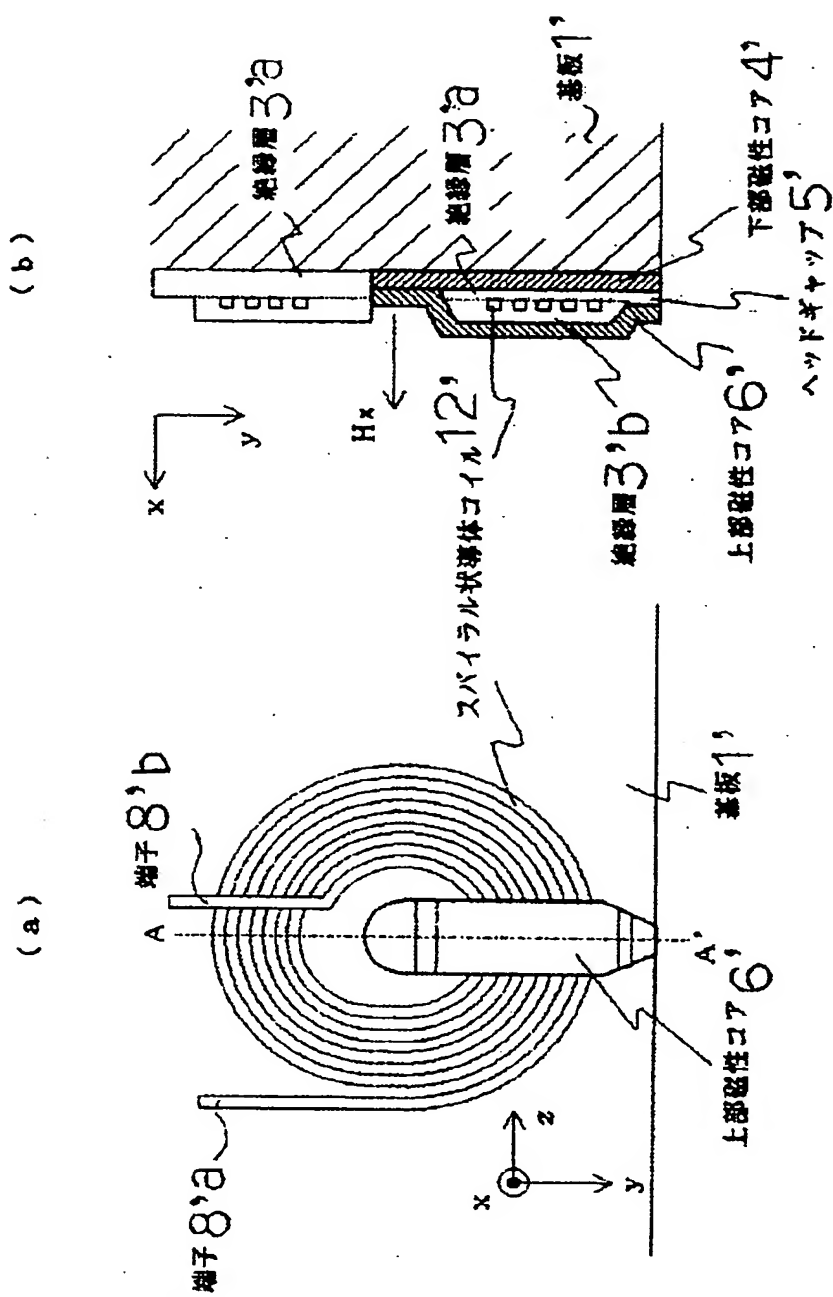


[Drawing 5]



[Drawing 6]





[Drawing 8]

